

# GLOMIS Electronic Journal

An electronic journal dedicated to enhance public awareness on the environmental importance of mangroves

## Use of mangroves in landfill management

A chronic environmental problem in developing country is the proper disposal of an increasing amount of solid wastes generated by growing urban populations. In many urban centers along the tropics and subtropics, mangroves located at the periphery of the metropolitan area has been used for solid waste disposal. This is certainly one of the major impacts on mangroves in developing countries today, causing permanent destruction of mangrove forests and their inhabitants.

Among environmental oriented governments, restoring mangroves along landfills has had a large success. Mangroves drastically reduce the aesthetic impact of solid waste disposal sites, and attracts large amount of animals, in particular birds, which also help to control rat and insect populations abundant in these areas. Recently, apart from these obvious benefits, mangroves have prove to be efficient biogeochemical barriers to the transfer of pollutants, generated in landfills, to adjacent coastal areas. Research carried in Australia and Brazil prove this so far unsuspected benefit from mangroves. On the other hand this will be a strong argument in favor of the restoration of damaged mangrove forests and conservation of those at the periphery of urban areas.

Mangroves act as biogeochemical barriers to pollutants generated in solid waste disposal sites through different mechanisms occurring at root level. Mangrove plants exude oxygen through their roots to cope with the anaerobic condition of the sediments. Thus, they create oxidized rhizospheres able of fixing heavy metals under non-bioavailable forms. Moreover, large root systems developed by mangrove tree species can retain and stabilize sediments more efficiently than bare sediments, avoiding the pollutant remobilization by physical disturbance.

These mechanisms have been successfully used at the Gramacho Metropolitan Landfill in Rio de Janeiro, Brazil, which receives about 7,000 tons of solid wastes per day. Mangroves around the landfill have undergone an intensive restoration program by the landfill administration and restoration is in full progress as seen by the comparison of mangrove areas in 1995 and 1998 (Fig. 1a,b respectively). Most important however, is the effective retention of heavy metals by mangrove sediments. A comparison of the distribution of heavy metals (such as Hg and Zn) in sediments of a degraded area, with those under mangroves at the Gramacho landfill (Fig. 2a, b, c), shows that the metal distribution profiles along sediment cores from the degraded area suggest remobilization and export of heavy metals from the sediments. Under mangroves, much larger metal concentrations are retained around the rhizosphere layer, within the sediments, hampering their migration, as seen from the sharp decrease in metal concentrations at the top layers of the sediment, and their export to adjacent coastal waters. Specialized studies showed that these heavy metals are present in the rhizosphere sediments under very refractory chemical forms, unable to be absorbed by plant roots, which thus blocks intoxication of the mangrove plant proper. Minimization of pollution by heavy metals should also be considered when valuating mangroves.

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Fig. 1. Aerial view of the Gramacho Landfill at Guanabara Bay, Rio de Janeiro, SE Brazil. Note surrounding mangrove belt with spots of non-vegetated mud flats.

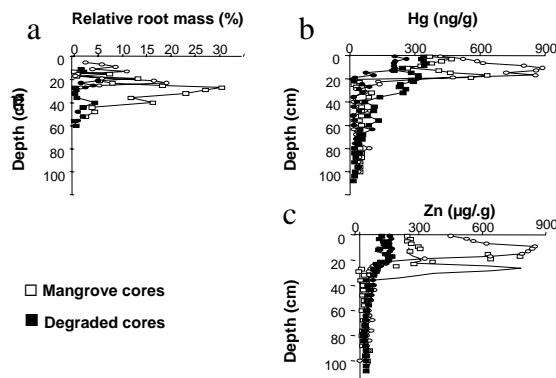


Fig. 2. Distribution of root biomass and heavy metals in sediment cores from mangrove forests and non-vegetated sites at Gramacho Landfill at Guanabara Bay, Rio de Janeiro, SE Brazil.

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